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Nasal schistosomiasis in Mute Swans in Switzerland

by

D. PALMER * and P. OSSENT *

With 2 figures and 1 table

Abstract

20 Mute Swans *(Cygnus olor)*, 8 Black Swans *(Cygnus atratus)*, 3 Mallards *(Anas platyrhynchos)* and 1 Great-crested Grebe were examined for nasal schistosomes. 16 Mute Swans proved to be infected. None of the other birds showed any evidence of nasal schistosomes. The main pathologic findings in the infected animals were a granulomatous rhinitis and cross sections of schistosomes in the blood vessels of the nasal mucosa. Attempts failed to establish the life cycle of the parasite by experimentally infecting laboratory bred freshwater snails (*L. peregra* and *L. stagnalis*). The results of the present investigation are discussed in relation to the occurrence of human cutaneous schistosomiasis.

The present communication is the first report of nasal schistosomiasis in birds in Europe.

INTRODUCTION

The occurrence of nasal schistosomiasis in birds was reported first by Fain (1955*a*, *b*, 1956, 1959) in central Africa. He described 5 species of *Trichobilharzia* from the nasal blood vessels of ducks, ibis and grebes. Up to that time, the only schistosome parasite known to inhabit the nasal blood vessels was *Schistosoma nasalis* (Malkani 1932) in the bovine. Subsequent to the discovery of nasal schistosomiasis in birds, Bearup (1957) found schistosome eggs in the nasal mucus of a Grey Teal in Australia. In a recent survey, it was shown that nasal schistosomiasis is very common in several species of Australian anatids (Blair & Ottesen 1979).

* Departement of Veterinary Pathology (Director: Prof. Dr. Dr. h.c. H. Stünzi) University of Zurich, Winterthurerstr. 260, CH-8057 Zürich, Switzerland.

MATERIALS AND METHODS

20 Mute Swans *(Cygnus olor)*, 8 Black Swans *(Cygnus atratus)*, 3 Mallards *(Anas platyrhynchos)* and 1 Great-crested Grebe *(Podiceps cristatus)* were examined. All animals were wild living birds from the lake of Zürich, except for the Black Swans, which were kept in captivity on the river Limmat 500 m downstream from the end of the lake. The animals were submitted to the zoo animal clinic of the University of Zürich for various reasons, mostly because of leg or wing fractures. Some of the Mute Swans showed leg weakness of unknown cause. All animals were euthanatized and a full post-mortem examination was carried out on the same day. For detection of the schistosome infection, nasal turbinals, nasal septa, basal nasal veins and associated structures were recovered to a dish of water, slightly teased and examined with a dissecting microscope for eggs, miracidia and worm fragments. Furthermore, intestinal contents was examined for miracidia using the method described by Mc Mullen & Beaver (1945).

Miracidia of schistosomes were easily detected and distinguished from other miracidia by the lack of an eyespot. After primary examination, the nasal turbinates, liver, lung, kidney and several areas of the gastrointestinal tract were fixed in neutral formalin and embedded in paraffin. Six μm thick sections of all tissues were stained with haematoxylin and eosin. In addition, serial transverse sections through at least six different parts of the nasal region were made. The tissues were examined for egg granulomas and for adult worms.

Attempts were made to establish the life cycle of the parasite. 40 laboratory bred, parasite free, *Limnaea peregra* and 40 *Limnaea stagnalis* were infected on several occasions with at least 10 freshly hatched miracidia each. All snails had a minimal diameter of 10 millimeters at the time of infection. Snails were examined for the emergence of cercariae at weekly intervals.

Table 1.

Incidence of nasal schistosomiasis in birds from the lake of Zurich

Host	Number examined	Parasitologic findings Miracidia	Histopathologic findings	
			Egg granulomas	Schistosomes in blood vessels
Mute Swan *(Cygnus olor)*	20	16	16	8
Black Swan *(Cygnus atratus)*	8	0	0	0
Mallard *(Anas platyrhynchos)*	3	0	0	0
Great-crested Grebe *(Podiceps cristatus)*	1	0	0	0

RESULTS

16 of the 20 examined Mute Swans showed evidence of nasal schistosome infection. The other bird species were negative.

The schistosome infected swans had numerous fine white opaque spots in the otherwise transparent nasal mucosa. However, these were only visible with the naked eye in the heavily infected animals. Histologically, the spots were revealed to be granulomas, containing many spindle shaped eggs in the centre surrounded by multinucleated giant cells and a dense infiltrate of inflammatory cells (Fig. 1). In some cases,

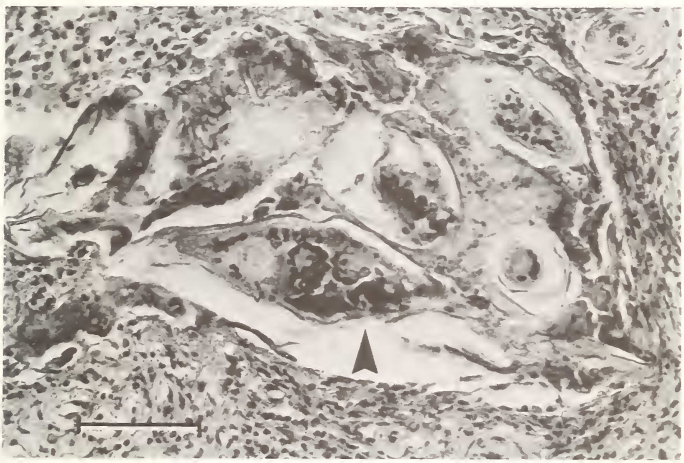

FIG. 1.

Histologic section through an egg granuloma. Note spindle-shaped schistosome egg in the centre (arrow). Bar represents 50 μm.

an increase in connective tissue was noted. The 16 Mute Swans positive for miracidia showed many egg granulomas histologically. However, schistosome cross sections in blood vessels could only be detected in the basal veins of the nasal mucosa in 8 of the 16 infected swans (Fig. 2). Evidence of adult schistosomes in the infected birds were so rare that it was necessary to examine several serial sections per area. The worms in the cross sections measured approximately 40 μm in diameter.

Cross sections of unidentified small trematodes were seen histologically in the blood veins of the core of the duodenal villi in 2 swans with egg granulomas in the nasal blood veins and in 3 swans negativ for nasal schistosomes. However, trematodes, eggs or egg granulomas could not be detected in the body cavity and mesenteric veins of any animal.

Only fragments of a male worm could be recovered from the nasal veins. It proved to belong to the genus *Trichobilharzia*.

Experimental infection of *L. stagnalis* and *L. peregra* did not result in the production of cercariae. All *L. peregra* died within 3 weeks of infection. Examination of

the snails for sporocysts was not possible due to rapid decomposition of the snails after death. The *L. stagnalis* were kept for 3 months without result. Dissection of the snails and histological examination of the internal organs did not reveal any evidence of infection with miracidia.

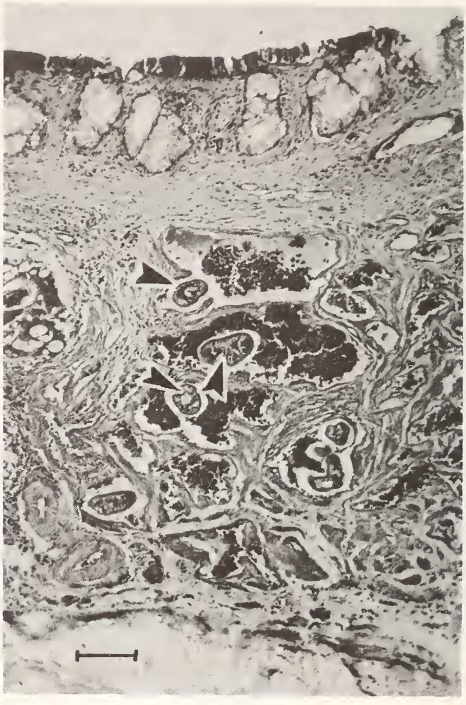

FIG. 2.

Section through nasal region of a swan with nasal schistosomiasis. Several cross sections of worms are visible in blood vessels (arrows). Bar represents 100 μm.

DISCUSSION

This investigation indicated that infection with nasal schistosomes is very common in swans on the lake of Zürich. Nasal schistosomiasis has been shown to occur in many waterfowl species, and in ibis and grebes (FAIN 1955*a*, *b*, 1956, 1959; BLAIR & OTTESEN 1979). However, this is the first report of this parasite in the swan. Nasal schistosomiasis in birds has a high incidence (FAIN 1955*a*; BLAIR & OTTESEN 1979). The pathology of nasal schistosome infection in birds has been briefly described by FAIN (1955 *a*). Although all swans examined by us showed a severe granulomatous rhinitis, the birds' general condition did not seem to be altered. Domestic ducks experimentally infected with cercariae of nasal schistosomes developed severe lameness during the acute phase of the infection (BLAIR & ISLAM 1983).

Attempts to establish the life cycle of the nasal schistosomes in the Mute Swan failed. This may have had several reasons. *L. peregra* and *L. stagnalis* could be the wrong intermediate host. Also the mode of infection may have been inappropriate. As stated by BLAIR & ISLAM (1983) schistosomes have a very restricted intermediate host specificity, whereas they can develop to adulthood in a range of unrelated bird species. Furthermore, experimental infection of snails with a too large number of miracidia may result in death of the intermediate host (ISLAM pers. comm.). All infected *L. peregra* in this study died within 3 weeks of infection. *L. stagnalis* did not show evidence of infection for up to 3 months. There is only one species of avian nasal schistosome with a fully known life cycle. There, development of the cercaria in the intermediate host takes 4 weeks (BLAIR & ISLAM 1983). However, this is a tropical parasite and nothing is know about nasal schistosomes in non tropical areas.

No attempts were made to determine the species of schistosome in the nasal blood vessels of the Mute Swans. The genus *Trichobilharzia* has been reviewed (FARLEY 1971; BLAIR & ISLAM 1983). For identification whole parasite specimens should be available but due to their length, adult schistosomes are most difficult to recover without damage, which makes their identification impossible (MCMULLEN & BEAVER 1945). Furthermore, to distinguish between species, the life cycle of the schistosome in question should be known (BLAIR & ISLAM 1983). However, *Trichobilharzia* species that occur in the nasal blood vessels do not appear to occur in the intestinal or mesenteric veins (FAIN 1955*a*; BLA.R & ISLAM 1983).

Cercariae of nasal schistosomes in birds are known to cause schistosome dermatitis in man and are probably the main cause of "swimmer's itch" in tropical Australia (BLAIR & COPEMAN 1977). "Swimmer's itch" in man has been reported from all over the world, including Europe (CORT 1950). It is usually associated with freshwater lakes, but there are also several reports of marine schistosome dermatitis (STUNKARD & HINCHLIFFE 1952; CHU & CUTRESS 1954; BEARUP 1955). In contrast to the many reports on schistosome dermatitis in man, the full life cycles of only few dermatitis producing cercariae are known (MCMULLEN & BEAVER 1945; NEUHAUS 1952; STUNKARD & HINCHLIFFE 1952; WU 1953; BOURNS *et al.* 1973). There is only one nasal schistosome in birds with a known life cycle (BLAIR & ISLAM 1983. However, waterfowl are most commonly suspected to be the appropriate final host of most dermatitis producing cercariae.

Between 1940 and 1950 several outbreaks of schistosome dermatitis occurred in public beaches on the lake of Zürich (HÄMMERLI 1952). In the following years, the cercariae in the lake were studied (MEYER & DUBOIS 1954; MEYER 1964). One of the dermatitis producing cercaria, *C. turicensis* (MEYER & DUBOIS 1954) has a similar morphology of the excretory system as two other cercariae which are known to occur in areas where avian schistosomiasis has been observed (BLAIR & ISLAM 1983). One of them has been proven to be the cercaria of a nasal schistosome (BLAIR & ISLAM 1983). It is therefore tempting to speculate that *C. turicensis* could be the cercaria of the nasal schistosomes in the Mute Swans of the lake of Zürich. MEYER & DUBOIS (1954) unsuccessfully attempted to infect mallard and coot with *C. turicensis*. However, they neglected to check the nasal mucosa for adult schistosomes or for eggs.

More detailed studies of the life cycle of the nasal schistosomes in Mute Swans are needed to fully evaluate the significance of this parasite. Also, more intensive investigations are warranted by the fact that a high percentage of Mute Swans were shown to be infected with schistosomes, and that its cercaria most likely causes dermatitis in humans.

Zusammenfassung

20 Höckerschwäne *(Cygnus olor)*, 8 schwarze Schwäne *(Cygnus atratus)*, 3 Stockenten *(Anas platyrhynchos)* und ein Haubentaucher *(Podiceps cristatus)* wurden auf das Vorkommen von Nasenvenen-Schistosomen untersucht. 16 Höckerschwäne waren mit diesen Parasiten befallen. Alle übrigen Vögel waren negativ. Mit Schistosomen befallene Schwäne zeigten pathologisch-anatomisch eine hochgradige granulomatöse Rhinitis. Versuche den Lebenszyklus des Parasiten herzustellen misslangen. Experimentell mit Miracidien infizierte Süsswasserschnecken (*L. peregra* und *L. stagnalis*) produzierten nie Cercarien. Die Resultate der vorliegenden Untersuchungen werden anhand der Literatur insbesondere in Bezug auf das Vorkommen der Schistosomendermatitis beim Menschen diskutiert. Die vorliegende Arbeit beschreibt zum ersten Mal das Vorkommen von Nasenvenen-Schistosomen bei Vögeln in Europa.

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